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LONG-TERM PRESERVATION METHOD FOR NOODLES
[MENRUI NO CHOKI HOZON HOHO]

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Specification

1. Title of the Invention

Long-term preservation method for noodle

2. What is Claimed is:

(1) A long-term preservation method for noodles, wherein wheat flour or buckwheat flour is blended with water, table salt and the like, the resulting mixture is rolled into a flat sheet and then cut in order to prepare raw noodles, and the resulting raw noodles, boiled noodles or packaged noodles are vacuum-cooled in order to form a dry coating on the surface.

(2) The long-term preservation method for noodles according to Claim 1, wherein ozone is added to the water.

(3) The long-term preservation method for noodles according to Claim 1, wherein ozone is added to the noodles when said noodles are being vacuum-cooled.

(4) The long-term preservation method for noodles according to Claim 1, wherein a packaging material used in a packaging machine is disinfected with ozone.

3. Detailed Description of the Invention

(Potential Industrial Applications)

The present invention relates to a long-term preservation method for noodles, such as udon noodles, buckwheat noodles, Chinese noodles and pasta.

[Prior Art]

In general, udon noodles, pasta, Chinese noodles and Japanese noodles consist mainly of wheat flour; the wheat flour is mixed with water or salt solution (in some cases, vitamins B_1 and B_2, calcium and the like have recently come to be added thereto) and the resulting mixture is formed into thin strips or a specific shape and can be boiled, not boiled (e.g., raw udon noodles, raw buckwheat noodles and raw Chinese noodles) or steamed (e.g., steamed Chinese noodles and pasta).

Of these, Chinese noodles can be produced with brine water, and Japanese buckwheat noodles can be produced by adding 30% or more buckwheat flour and a tackifier, such as chicken eggs and yam.

FIG. 5 is a block diagram illustrating a conventional manufacturing method for noodles, in addition to wheat flour and buckwheat flour, examples of the raw materials 1 that can be used in noodles include grain flour which is flour of grains which can be consumed by granulating them,

such as rice flour, corn flour and soy bean flour, and starch of potatoes and beans; of these wheat flour is so different from the others that, when the wheat flour is mixed with water, the protein forms gluten, thereby providing a peculiar stickiness.

This gluten plays a role as a sticky binding agent in order to form the composition of noodles.

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Since the other grain flour has no such characteristics, wheat flour has conventionally been used in noodles and also used as an essential sticky binding agent to make noodles with other grain flour.

The above-mentioned raw materials 1 are introduced into a mixer 2, water and additives (e.g., table salt, a reinforcing agent, brine water in the case of preparing Chinese noodles, and vitamins according to the intended product) are mixed therein by using a stirrer equipped with the mixer 2, the mixing/kneading is conducted while it is being stirred for 10 to 20 minutes such that the wheat flour can be uniformly mixed with water and table salt, and thus water absorption promotes the formation of gluten of wheat flour. Next, the resulting mixture is fed into rollers in the rolling step 3 in order to form the mixture into noodle sheets. The resulting mixtures are serially inserted between a pair of rollers in order to obtain two noodle sheets, and the two noodle sheets are then simultaneously inserted into a pair of rollers in order to obtain a noodle mix sheet. The resulting noodle mix sheet is rolled up using a wood shaft and is then aged in order to equalize the moisture content.

Next, a kneading/rolling step 4 is conducted. The objectives of this step are to knead the noodle sheet while applying a pressure to the noodle sheet so as to equalize the moisture content and to adjust the thickness of the resulting noodle sheet to an appropriate thickness for cut noodles. When the noodle sheet is rapidly rolled, the surface of the resulting noodle sheet becomes rough, and 5 or 6 steps of rollers are therefore generally used.

The surface of the noodle sheet may vary depending on the water content during mixing and kneading raw materials in the mixer with a stirrer, the adoption of an ageing step and the types of additives used.

Once the noodle sheet is rolled to a required thickness according to the intended product, the resulting sheet is fed onto rollers of a cutter 5 so as to be serially cut. Two pairs of rollers are generally equipped with the cutter, one pair of which catch and feed noodle sheets to cutting blades and the other pair of which having

a smaller diameter calenders the noodle sheets until the noodle sheets reach the cutting blades. The cut noodles are raw noodles 6, which are udon noodles, buckwheat boodles or Chinese noodles depending on the raw materials used.

The resulting raw noodles 6 generally have a water content of approximately 33%. From this step, raw noodles and boiled noodles take different steps.

Raw noodles 6 are packaged in a packaging machine 7 according to the intended production form, weighted and classified 8, and stored in a refrigerator 9 until shipment 10.

As for boiled noodles, the raw noodles are introduced into a boiling tank 11 by using a basket which runs through inside the boiling tank. The noodles are boiled in this boiling tank 11 (at a temperature of approximately 98 degrees Celsius for 10 to 20 minutes), when 2 to 3 minutes has elapsed after the heating is terminated, the resulting noodles are serially exposed to air, cooled in cold water in a cooling tank 12 to a temperature of approximately 6 degrees Celsius, are then fed to a preservation improving tank 13 in order to produce boiled noodles 14, which are then fed to the packaging machine 7.

Noodles are currently produced by the above-described steps.

[Problem to be Solved by the Invention]

The problems of the current production method include short preservation. For example, the preservation term is 1 to 2 days in summer and approximately 10 to 20% of the products are therefore returned. The preservation term is 5 to 6 days even in winter, with the preservation term over the counter being 3 to 4 days.

To solve this problem contributes not only to saving energy but also to improving the production yield, which is highly advantageous. (The current bouncer rate is reported as 10 to 20%).

The current production method includes some problems in the processing methods and treatment techniques.

The first problem is contamination by bacteria and microorganisms found in the raw materials, the production equipment and the factory environment. First, when wheat flour used as a raw material is investigated, the viable bacteria count detected is approximately 5 to 6×10^2 and the filamentous bacteria count detected is approximately 1 to 2×10. However, the above-described fact has not been reported as a problem because the bacteria count is too slight to become a direct cause of the putrefaction and the water content is too small to cause the water activity. Hence, the flour itself does not deteriorate.

However, by friction heat and air contaminant during mixing for 10 to 20 minutes in the kneading step (in a mixer), the viable bacteria count increases by approximately 1 to 5×10^4 and the filamentous bacteria count increases by approximately 3 to 7×10. This increase in the bacteria count causes problems later. Hence, raw noodles 6 encounter a serious issue while the disinfection and sterilization of noodles 14 to be subjected to a heat treatment (i.e., boiled noodles) can be possibly attained.

Further, a 10^1 to 10^2 increase in bacteria can also be observed in the rolling step 3 and the kneading/rolling step 4.

Hence, the inhibition of initial bacteria affects the preservation quality of the final product.

Further, boiled noodles (packaged noodles) are individually packaged after cooling the boiled noodles in cold water at a temperature of approximately 6 degrees Celsius and draining them, but in the case of simple-packaged noodles which have been allowed to stand at room temperature (25 to 30 degrees Celsius) for approximately 50 hours (i.e., for approximately 2 days), the bacteria count reaches approximately 1 to 2×10^6 and the noodles are therefore completely putrid.

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Further, the same results were obtained when the noodles were preserved at a temperature of 6 degrees Celsius for approximately 6 days. Therefore, the product preservation has been conventionally conducted without a disinfecting treatment or considering the water content but only by adjusting temperature in order to inhibit the increase in bacteria.

A hydrogen peroxide treatment has been previously adopted, but hydrogen peroxide is currently classified as a carcinogenic substance and the use thereof is therefore prohibited.

Further, in the case of boiled thick udon noodles, for example, when 100 g of cut raw noodles are allowed to stand in a boiling tank at a temperature of 95 to 98 degrees Celsius for approximately 20 minutes, are then introduced into cold water in a cooling tank at a temperature of approximately 6 degrees Celsius for dip-cooling for approximately 3 minutes, the weight of the product becomes approximately 240 g. Hence, the water content significantly increases, which induces the increase in bacteria.

The second problem is the cooling step using the refrigerator 9.

Of noodles, raw noodles are individually packed without a sterilization treatment, are then air-cooled in

the refrigerator 9 in order to inhibit the increase in bacteria, and distributed to consumers along the distribution line. The air-cooling method in this step is an indirect cooling from the external surface of the packaging material 15 as shown in FIG. 6.

The packaging material 15 is first cooled, the air inside the packaging material 15 is cooled, and the noodles are then cooled gradually from the surface to the center.

This serial cooling is thermodynamically effective but poses a problem in terms of a product, because considerable time and heat energy are required in order to transfer heat to noodles, which are the primary object for cooling. If a considerable time is required for the cooling process, since the initial bacteria are not zero, the proliferation is repeated and the bacteria count always reaches a particular value.

From the standpoint of saving energy, equipment which meets the cooling load for cooling the air 19 and the packaging material 15 is required. The boiled noodles 14 encounter the same problem but also encounter additional problems.

This result in the above-mentioned high water content as compared with the raw noodles 6. More specifically, due to the repeated air-cooling, the water held by noodles is

evaporated by the second law of thermal energy (i.e., heat is transferred from high-temperature areas to low-temperature areas) and generates dew condensations 29 inside the packaging material by the external cooled heat. This condensed 29 water causes problems.

More specifically, the problems include a problem with the aesthetic value and a problem in that the dew condensations can be contaminated again by bacteria in the air in the packaging material between the period between the refrigerator to consumers, and fall onto the surface of the noodles. The increase in bacteria initiated again at the point where the contaminated dew condensations fall, thereby accelerating the rate of putrification.

The third problem is the contaminated state of the packaging material for produced noodles.

In general, rolled or bag-like packaging materials with prints by a printing maker are purchased from a film maker, stored in a storage for packaging materials, and used according to the need in order to pack the product. Strange to say, no disinfection treatments are conducted in any of the above steps.

The shape of the packaging material 15, which can be used by rolling it as shown in FIG. 7 and then forming it into a bag, has dust on both cut-surfaces, and when a

viable bacteria count was measured toward the center core, contamination with a viable bacteria count of 1 to 2×10^2 was detected. Hence, no matter how many noodles are disinfected and whether the increase in bacteria is inhibited, the improvement in the preservation cannot be expected without solving the problems with packaging materials.

The present invention intends to improve the preservation of noodles by a vacuum technique and an ozone application technology.

[Means of Solving the Problem]

The present invention relates to a long-term preservation method for noodles, wherein wheat flour or buckwheat flour is blended with water, table salt and the like, the resulting mixture is rolled into a flat sheet and then cut in order to prepare raw noodles, and the resulting raw noodles 6, boiled noodles 14 or packaged noodles 16 is vacuum-cooled in order to form a dry coating.

The present invention is further characterized in that ozone is added to the noodles when the noodles are being vacuum-cooled.

The present invention is further characterized in that ozone is added to the water.

The present invention is furthermore characterized in that a packaging material 15 used in a packaging machine is sterilized with ozone.

[Operation]

Due to the dry coating, the raw noodles 6 and boiled noodles 14 can prevent bacteria from propagating; therefore, the raw noodles 6 and boiled noodles 14 inhibit putrification, thereby achieving the long-term preservation.

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[Embodiments]

FIG. 6 is a block diagram illustrating a long-term preservation method for the raw noodles 6 according to the present invention, and the same callouts are provided for the same sections as appeared in FIG. 5 and only different sections are described below.

The raw noodles 6 are fed to a vacuum-cooling step 20.

FIG. 3 (a) shows equipment which performs the vacuum-cooling step 20. This equipment comprises a vacuum tank 21 and a vacuum pump 22 and the fed noodles are set inside the vacuum tank 21 (cooling tank).

The vacuum-cooling tank 21 comprises a condenser trap 23. This condenser trap 23 is usually provided outside the cooling tank, but since this condenser trap can be affected by the dispersion or absorption heat, which may become a

cause of significantly reducing the performance of vacuum cooling, and is therefore provided in the vacuum-cooling tank 21. In this configuration, since the steam evaporated can be directly liquefied in the vacuum-cooling tank 21, the space for the cooling trap can be obviated as compared with the case of providing the condenser trap outside the cooling tank and, further, the condenser trap provided inside can be significantly readily cleaned while the case of providing the condenser trap on a pipeline outside requires a disassembly cleaning.

The raw noodles 6 introduced into the cooling tank 21 are cooled according to the following principle. Water under at atmospheric pressure (i.e., the state where ordinary people live on earth) boils at a temperature of 100 degrees Celsius but can boil even at a temperature of 0 degree Celsius under vacuum.

This relationship is shown in FIG. 3 (b).

The ordinate of the graph shows degrees of vacuum and the abscissa of the graph shows temperatures. For example, water at a degree of vacuum of 6 mmHg boils at a temperature of approximately 3 degrees Celsius. Hence, when the degree of vacuum is maintained at 6 mmHg, water keeps boiling at a temperature of approximately 3 degrees Celsius and matter containing the water is cooled to a temperature

of 3 degrees Celsius. Further, in this case, due to the boiling heat transfer, the raw noodles 6 can be uniformly and rapidly cooled and the temperature variation can be prevented because the noodles contain water.

More specifically, there is no temperature difference between the outside and the inside of the raw noodles 6.

In this case, water is surely evaporated and can be cooled at an evaporative latent heat of approximately 750 cal/kg; therefore, the cooling can be effectively performed. The quantity of the evaporative latent heat can be determined according to the initial feed temperature. Water can be evaporated even by cooling in a refrigerator and no problem is therefore caused on the final product.

When this latent heat is removed, a thin dry coating is formed on the surface of the noodles. If falling bacteria are attached to the surface, the increase in the bacteria can be prevented due to the low water activity value on the surface.

Since there is no temperature variation in the raw noodles 6, when the raw noodles 6 are removed from the packaging, the generation of dew condensation can be prevented inside the packaging material, and this dry coating can prevent the dew condensation from returning to the product, i.e., so-called “drip contamination”.

Therefore, the raw noodles 6 can be preserved for a prolonged period of time, with preferred appearance in shops.

In the vacuum-cooling tank 21, the propagation of putrefactive bacteria can be prevented and the cooling time can be 10 or more times reduced as compared with the cooling by blowing cold air (in the refrigerator 9).

More specifically, in the case where bacteria have been adhered to the product stored in the refrigerator, the propagation of the bacteria is continued; therefore, it is important that cooling is rapidly conducted in order to prevent the propagation at a low temperature. This rapid-cooling and the inhibition of respiration heat of the raw noodles 6 can be simultaneously conducted by the vacuum cooling.

In the case of using boiled noodles 14 instead of raw noodles 6, the same dry coating can be formed on the surface, thereby achieving the same effect.

Packaging is the most critical issue in the case of cooling the product by vacuum cooling as described in the embodiment shown in FIG. 1. More specifically, in the case of vacuum cooling, it is impossible to conduct cooling in a completely sealed container due to the heat exchange between water evaporation and latent heat.

Therefore, it is ideal to conduct cooling without packaging, but it is possible that the cooled product is contaminated again during packaging. This method is ideal but is not practical.

FIG. 2 is a block diagram illustrating a long-term preservation method for the boiled noodles 14 according to the present invention, and the same callouts are provided for the same sections as appeared in FIG. 5 and only different sections are described below.

The packaged noodles 16 obtained by packaging the boiled noodles 14 (or the raw noodles 6) in the packaging machine 7 are fed to the vacuum-cooling step 20.

As shown in FIG. 4 (a), the packaged noodles 16 can be practically vacuum-cooled in this form by introducing boiled noodles 14 into the packaging material 15, and the contamination of bacteria can be prevented to some extent by sealing the opening 17 immediately after cooling.

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Further, another aspect of the present invention includes, as shown in FIG. 4 (b), obtaining a complete product by packaging the noodles with the packaging material. In this case, a few holes 18 having a size of several mm are provided on the upper portion, lower portion or either surface. The hole diameter may vary depending on

the product weight, but can be appropriately determined by calculating the quantity of evaporative latent heat. By this method, the products can be put on the distribution line, except that they must be stored in the refrigerator 9 immediately after cooling. In addition, since the direct contact of the noodles with hands can be avoided and the dry coating has been formed, this packaging form is ideal as long as the storing is maintained at an appropriate temperature.

As described in Claim 2 in the present invention, ozone can be preferably added to the water to be added to the raw material 1.

As described above, bacteria and microorganisms can be found as initial bacteria in the raw materials, the production equipment and the factory environment. In the present embodiment, ozone water is used for disinfection.

The increase in the initial bacteria can be promoted by the friction heat during mixing materials and the amount of water added. More specifically, the addition of ozone water containing several ppm to several tens of ppm to the product as a mixing water (additional water) is significantly effective.

Ozone, which is a molecule (O_3) to which 3 oxygen atoms are attached, is a gas which has a weak atomic bond, can be

readily decomposed due to the unstable characteristics and has a high oxidizing strength.

Further, ozone is decomposed in air; it is reduced to 50% in appropriately 1 hour and becomes 0 in approximately 3 hours.

Further, ozone can disinfect initial bacteria or the like by the bactericidal activity which is approximately 7 times higher than that of chlorine; for example, Escherichia coli can be killed in 2 seconds by the use of 2 ppm of ozone water.

Hence, even if bacteria are not completely killed, the reduction effect in the initial bacteria is high. More specifically, since bacteria increases at a square rate in the following steps, it is ideal that the amount of generated bacteria is small or none.

In the vacuum-cooling step 20 shown in FIG. 3, air containing 0.1 to 50 ppm of ozone can be introduced into the vacuum tank 21.

As described above, the packaging material 15 is not disinfected. Claim 4 in the present invention is characterized in that, as shown in FIG. 8 (a), the packaging material 15 is dipped in the ozone water which has been used during mixing the above-described raw materials 1 and is then cleaned. In the case of packaging

materials 15 which are not intended to be wet, a (dry) disinfection can be performed as shown in FIG. 8 (b) by introducing the packaging material 15 into a container 30 which forms a chamber and blowing ozonized air 31 thereto. This method has a low disinfection rate as compared with water-soluble ozone but is effective when the method is retained. 32 is a filter.

[Test Examples]

Test Examples were described with reference to the inventive production method and a device used in the production method

First, the bacteria count and preservation effect of boiled udon noodles taken as samples A and B of noodles produced by conventional production method are as follows.

	サンプルA	サンプルB	
[illegible]	5.5×10^3	5.5×10^4	([illegible]/g)
〃 [illegible]	1.2×10	2.3×10	(〃)
[illegible]	5.7×10^3	9.4×10^2	(〃)
〃 [illegible]	5.2×10	7.3×10	(〃)
[illegible]	7.5×10^3	7.5×10^2	(〃)
〃 [illegible]	7.4×10	7.1×10	(〃)
〃 [illegible]	3.0×10	2.8×10	(〃)

[Tr. ---- Row 1: (blank); Sample A; Sample B

Column 1: (blank); Bacteria count of raw material wheat flour (viable bacteria); Bacteria count of raw material wheat flour (filamentous bacteria); Upon completion of mixing (viable bacteria); Upon completion of mixing (filamentous bacteria); Upon completion of the production of raw noodles (viable bacteria); Upon completion of the production of raw noodles (filamentous bacteria); Upon completion of the production of raw noodles (reddish-brown filamentous bacteria)]

The results are shown above. Each sample was divided into 3 groups and subjected to a preservation test.

	サンプルA			サンプルB		
[illegible]	48Hr	45Hr	46Hr	40Hr	43Hr	41Hr
[illegible]	161Hr	132Hr	142Hr	50	58	58

[Tr. ---- Row 1: (blank); Sample A; Sample B

Column 1: Allowed to stand at 30°C (summer); Allowed to stand at 6°C (winter)]

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Times (Hr) shown above are the period taken until the samples had 10^6 or more bacteria and became putrid.

The results show that the times significantly depend on the initial count of the bacteria and the temperature conditions.

It is assumed that the difference of times between the groups of the same sample resulted in the slight temperature differences caused by the distribution of bacteria and the location of the sample placed.

The results support the fact that the preservation in an ordinary summer is 1 to 2 days and in an ordinary winter is 4 to 7 days is the industry consensus.

Next, the inventive method and device were applied to the process for the same raw materials used in the samples A and B, with the procedure and results being shown in the following.

[illegible]			
[illegible]		[illegible]	
50ppm	1ppm	50ppm	1ppm
3.1×10	1.6×10^3	3.7×10	1.8×10^3

[Tr. ---- Row 1: Upon completion of mixing (bacteria count) Row 2: Sample A; Sample B]

The procedure is as follows: the bacteria counts of initial bacteria in wheat flour and the like were the same. Water is usually added to the wheat flour and, further, ozone water (concentration 50 ppm and 1 ppm) obtained by introducing ozone generated from an ozone generator into

water was additionally introduced into a mixer during mixing raw materials.

The mixing time from the period when the ozone water was added was 20 minutes.

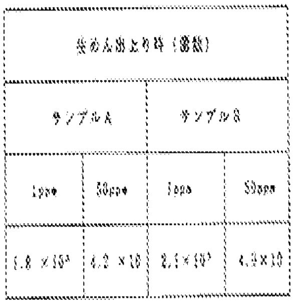
Hence, the significant reduction in bacteria count as compared with the initial bacterial count can be obtained.

In sample A, in the case of using the ozone water having a concentration of 50 ppm, the sterilizing effect was increased by 310/(9700+620) = 3.0/100 times, and in the case of using the ozone water having a concentration of 1 ppm, the sterilizing effect was increased by 1600/(9700+620) = 15/100 times.

In sample B, in the case of using the ozone water having a concentration of 50 ppm, the sterilizing effect was increased by 370/(9400+710) = 3.6/100 times, and in the case of using the ozone water having a concentration of 1 ppm, the sterilizing effect was increased by 1800/(9400+710) = 17.8/100 times.

These values show that the sterilizing effect by ozone, which is essential for the prolonged preservation, is high.

The following shows the reproductive state of the bacteria in the samples which had been cut upon completion of the rolling/kneading step.



生めん出上り時（菌数）			
サンプルA		サンプルB	
1ppm	50ppm	1ppm	50ppm
1.8×10^4	4.2×10	2.1×10^3	4.3×10

[Tr. ---- Row 1: Upon completion of the production of raw noodles (bacteria count)

Row 2: Sample A; Sample B]

Carried to its conclusion, the bacteria count in the rolling, kneading and cutting steps is slightly increased. It is assumed that the slight increase results in the friction heat during rolling, the infection from equipment, the falling bacteria and the like. This issue is not critical and can be prevented to some extent by conducting usual cleaning and preventing the bacteria from falling in factories.

Therefore, this issue is not raised if the initial bacteria count is small.

Next, the test was conducted according the methods for raw noodles and boiled noodles.

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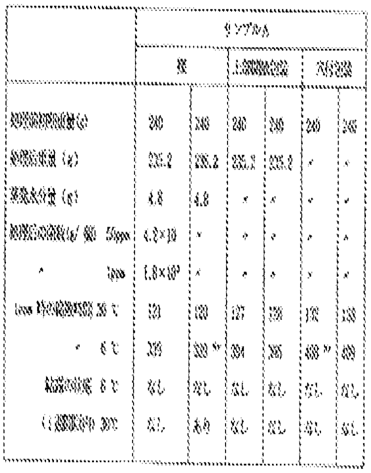
First, as for raw noodles, a sample prepared by packaging the product in a packaging material having 2 holes having a diameter of 2 mm, a sample prepared by introducing the product into a packaging material with the upper opening being opened, and a sample prepared from unprocessed product were vacuum-cooled.

The test was conducted by placing two units of each sample in the same cooling tank and measuring the bacteria count. The vacuum pressure was 8 mmHg and the final product temperature was 5 degrees Celsius. The product temperature before the product was introduced into the vacuum-cooling tank was 24 degrees Celsius. The vacuum treatment time was 21 minutes.

The packaging material used was disinfected by ozone (15 minutes, in ozone water having a concentration of 10 ppm). According to the above-described data, the bacteria counts of ordinary viable bacteria and Escherichia coli were assumed to be zero.



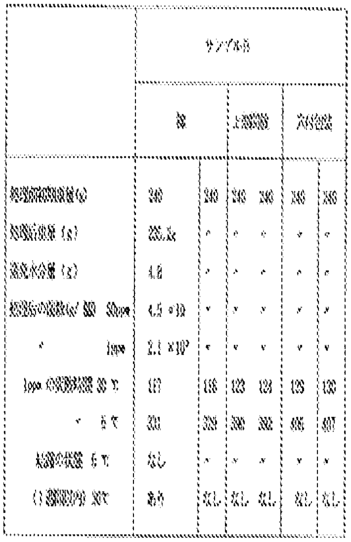
[Tr. ---- Row 1: Sample A;

Row 2: Unprocessed sample; Package with the upper portion opening; Package with holes

Row 10 (Presence of dew condensation at 6°C): Absent; Absent; Absent; Absent; Absent; Absent

Row 11 (Presence of dew condensation (within 1 week) at 30°C): Absent; Present; Absent; Absent; Absent; Absent

Column 1: (blank); Initial weight before process (g); Weight after process (g); Evaporated water content (g); Bacteria count after process (g/bacteria) 50 ppm; Bacteria count after process (g/unit) 1 ppm; Putrid time at 1 ppm at 30°C; Putrid time at 1 ppm at 6°C; Presence of dew condensation at 6°C; Presence of dew condensation (within 1 week) at 30°C]



[Tr. ---- Row 1: Sample B;

Row 2: Unprocessed sample; Package with the upper portion opening; Package with holes

Row 10 (Presence of dew condensation at 6°C): Absent; Absent; Absent; Absent; Absent; Absent

Row 11 (Presence of dew condensation (within 1 week) at 30°C): Present; Absent; Absent; Absent; Absent; Absent

Column 1: (blank); Initial weight before process (g); Weight after process (g); Evaporated water content (g); Bacteria count after process (g/unit) 50 ppm; Bacteria count after process (g/unit) 1 ppm; Putrid time at 1 ppm at 30°C; Putrid time at 1 ppm at 6°C; Presence of dew condensation at 6°C; Presence of dew condensation (within 1 week) at 30°C]

According to the above data, all the samples have the same initial bacterial count, weight and water content. As a result, the unprocessed sample did not confront any problems during cooling it but, when it is removed from the cooling tank and packaged or during transportation (from the vacuum-cooling tank to the packaging machine), the unprocessed sample can be affected by falling bacteria and adhesive bacteria due to hand activities; therefore, it is assumed that the preservation term is short. However, even by this method, the preservation term was found to be significantly improved as compared with the above-described non-treatment method (conventional method). The preservation term can be reliably prolonged to 2 to 3 days or more. Further, compared to the package with the upper portion opening and the package with a few holes having a diameter of several mm, as shown above, the package with holes has an improved preservation. The result is assumed to be because of the slight time lag as described above from the removal of the product from the cooling tank to the completion of sealing in the packaging machine. The packaging material with holes appears to confront the problem of secondary contamination, but the increase in the bacteria in noodles having the dry coating can be prevented

consequently by the coating and, if bacteria are adhered to the noodles, no noticeable difference from the case of a sealed container can be seen as long as the temperature is managed.

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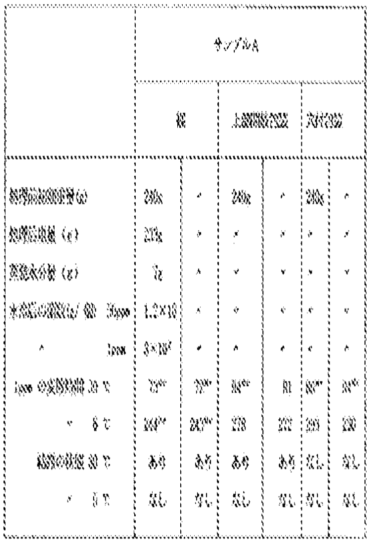
In order to ensure the full effect, more improved preservation can be expected by a double packaging. Further, drips (dew condensation) can be prevented by rapid-sealing. In the case of the package with holes, the water which may become dew condensation can be discharged to outside through the holes. Further, it was found that the noodles which have been vacuum-cooled by external pressure generated no dew condensation. It was also found that the unprocessed noodles can be prevented from generating dew condensation depending on the contacting time to air, i.e., by sealing the noodles immediately after cooling. As a result, some noodles generated dew condensations and others did not.

Next, the test was conducted on the boiled noodles. Samples prepared were, as described above, an unprocessed sample, a package with the upper portion opening and a package with holes. Two units of each sample were boiled at a temperature of 98 degrees Celsius for 20 minutes and dip-cooled in cold water at a temperature of approximately 6

degrees Celsius for 3 minutes. The temperature of the removed samples was 9.8 degrees Celsius. Drained products were packaged according to each packaging form and were then introduced into a vacuum-cooling tank at a vacuum pressure of 8 mmHg, and the final product temperature was set to be 5 degrees Celsius. The vacuum time was 16 minutes. The weight of the raw noodles was 100 g, and the weight was increased 240 g when they were boiled.



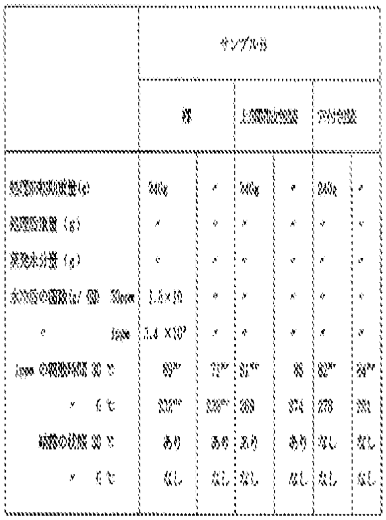
[Tr. ---- Row 1: Sample A;

Row 2: Unprocessed sample; Package with the upper portion opening; Package with holes

Row 10 (Presence of dew condensation at 6°C): Present; Present; Present; Present; Absent; Absent

Row 11 (Presence of dew condensation (within 1 week) at 30°C): Absent; Absent; Absent; Absent; Absent; Absent

Column 1: (blank); Initial weight before process (g); Weight after process (g); Evaporated water content (g); Bacteria count after process (g/unit) 50 ppm; Bacteria count after process (g/unit) 1 ppm; Putrid time at 1 ppm at 30°C; Putrid time at 1 ppm at 6°C; Presence of dew condensation 30°C; Presence of dew condensation at 6°C]



*The term "putrid time" refers to the time when the bacteria count reached 10^6 or more.

[Tr. ---- Row 1: Sample B;

Row 2: Unprocessed sample; Package with the upper portion opening; Package with holes

Row 10 (Presence of dew condensation at 6°C): Present; Present; Present; Present; Absent; Absent

Row 11 (Presence of dew condensation (within 1 week) at 30°C): Absent; Absent; Absent; Absent; Absent; Absent

Column 1: (blank); Initial weight before process (g); Weight after process (g); Evaporated water content (g); Bacteria count after process (g/unit) 50 ppm; Bacteria count after process (g/unit) 1 ppm; Putrid time at 1 ppm at 30°C; Putrid time at 1 ppm at 6°C; Presence of dew condensation 30°C; Presence of dew condensation at 6°C]

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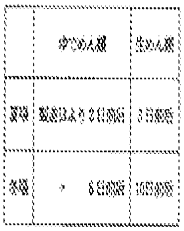
As described above, it was found that the bacterial count once reaches zero in the boiling step but increases again in the cooling step.

This is because of the contamination of the cold water; the increase in the bacteria can be inhibited by constantly adding sterile cold water or adding ozone.

According to the data shown above, the unprocessed sample has inferior preservation to the other packaging forms for the same reason as described above. Boiled noodles have a higher water content than raw noodles and therefore quickly become putrid. This is because the high water content and high water activity promote the propagation of bacteria.

Further, there was a slight difference between the package with the upper portion opening and the package with a few holes as in the case with the previous test, for the same reason as above. The rate of putrification is obviously increased in the case of retaining at a temperature of 30 degrees Celsius, but processed samples still have an improved preservation as compared with the unprocessed sample.

Conventional products become putrid within the following days:

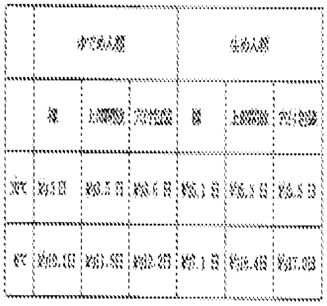


[Tr. ---- Row 1: (blank); Boiled noodles; raw noodles

Row 2: Summer time; Approximately 2 days after the production; approximately 3 days

Row 3: Winter time: Approximately 6 days after the production; approximately 10 days]

The products processed by the device according to the present invention become putrid within the following days:



	[illegible]			[illegible]		
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30℃	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6℃	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[Tr. ---- Row 1: (blank); Boiled noodles; Raw noodles

Row 2: (blank); Unprocessed sample; Package with the upper portion opening; Package with holes

Row 3: 30°C: Approximately 3 days; Approximately 3.5 days; Approximately 3.6 days; Approximately 5.1 days, Approximately 5.3 days; Approximately 5.5 days

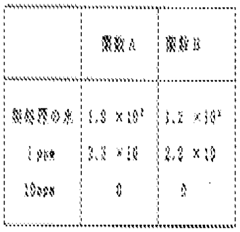
Row 4: 6°C: Approximately 10.1 days; Approximately 11.5 days; Approximately 12.2 days; Approximately 7.1 days, Approximately 16.4 days; Approximately 17.0 days]

From the results, the effect is obvious.

It is also obvious that the storage temperature is important.

It was found that packaging material with a few holes having a diameter of several mm had the most improved preservation of all the packaging forms.

Further, in the cooling step, when ozone (ozone water) is added to the cooling tank, the following results were obtained. Two types of ozone water having a concentration of 1 ppm and 10 ppm were used. The temperature of the water was 6 degrees Celsius. The bacteria count was measured when 10 minutes had elapsed after the ozone water was added.



	[illegible] A	[illegible] B
[illegible]	[illegible]	[illegible]
1 ppm	3.3 × 10	2.2 × 10
10ppm	0	0

[Tr. ---- Row 1: (blank); Bacteria count A; Bacteria count B

Column 1: (blank); Unprocessed water; 1 ppm; 10 ppm]

As described above, when ozone water is added in order to manage the water quality, the secondary contamination can be prevented and the disinfection effect on the product can also be obtained.

[Effect]

As described above, since the present invention uses vacuum-cooling and ozone water for the production of the above-mentioned noodles, the generation of initial bacteria can be minimized and the production can be effectively, economically and continuously conducted.

Further, the present invention provides a long-term preservation method for noodles, wherein, in order to achieve the above-described object, ozone water is added in

the mixer mixing step, thereby simultaneously preventing the propagation of bacteria and disinfecting the bacteria; and in the cooling step by exposing noodles to water, ozone is added to the water such that the ozone water prevents the propagation of bacteria and disinfecting the bacteria. As for packaged noodles, a vacuum-cooling method, which is a sterile cooling method, is adopted, the packaging material itself is cleaned and disinfected by ozone water and maintained by ozone, and the generation of drip (dew condensation) in the vacuum-cooled packaging material can be prevented; therefore, the preservation can be prolonged to be approximately 1 to 2 weeks.

4. Brief Description of the Drawings

FIG. 1 is a block diagram illustrating an embodiment according to the present invention,

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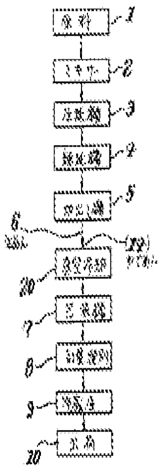
FIG. 2 is a block diagram illustrating another embodiment according to the present invention, FIG. 3 (a) is a diagram illustrating a device for the vacuum-cooling step, FIG. 3 (b) is a graph of the relationship between the degree of vacuum of vapor pressure of water and temperatures, FIG. 4 (a) is a perspective view of a package, FIG. 4 (b) is a vertical cross-sectional view of another example of a package, FIG. 5 is a block diagram illustrating

conventional production method for noodles, FIG. 6 is a vertical cross-sectional view of a package, FIG. 7 is a perspective view of a packaging material, FIG. 8 (a) is a diagram illustrating the disinfection of a packaging material using ozone water according to the present invention, and FIG. 8 (b) is a perspective view of the disinfecting device using the ozone.

6 - raw noodles, 14 - boiled noodles, 16 - packaged noodles

Agent Gen Ishido, Patent Attorney

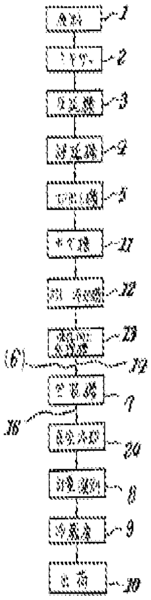
[FIG. 1]



[Tr. ---- 1. raw materials; 2. mixer; 3. rolls; 4. kneader/roller; 5. cutter; 6. raw noodle; (14): boiled

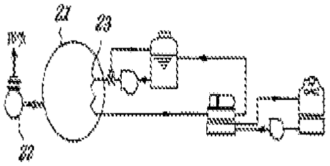
noodle; 20: vacuum-cooling; 7. packaging machine; 8: weighing and classification; 9: refrigerator; 10 shipment]

[FIG. 2]



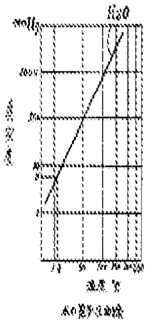
[Tr. ---- 1. raw materials; 2. mixer; 3. rolls; 4. kneader/roller; 5. cutter; 11. boiling tank; 12: cooling tank; 13: preservation improving tank; 7. packaging machine; 20: vacuum-cooling: 8: weighing and classification; 9: refrigerator; 10 shipment]

FIG. 3. (a)



[Tr. ---- (left) Exhalation]

FIG. 3 (b)



[Tr. ---- Ordinate: degrees of vacuum;

Abscissa: temperatures

(bottom): Vapor pressure curve of water]

FIG. 4 (a)

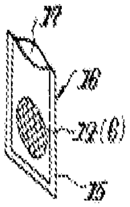


FIG. 4 (b)

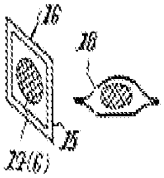
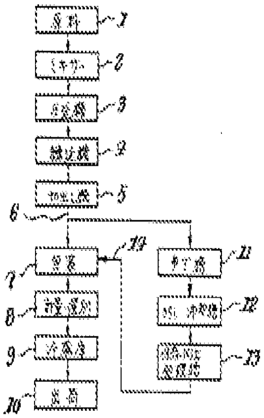


FIG. 5



[Tr. ---- 1. raw materials; 2. mixer; 3. rolls; 4. kneader/roller; 5. cutter; 11. boiling tank; 12: expose-cooling tank; 13: preservation improving tank; 7. packaging machine; 8: weighing and classification; 9: refrigerator; 10 shipment]

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FIG. 6

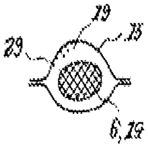

FIG. 7

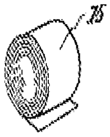

FIG. 8 (a)

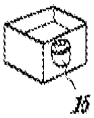

FIG. 8 (b)